ELSEVIER

Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Gold, bonds, and epidemics: A safe haven study

Tonmoy Choudhury [a], Harald Kinateder [b,*], Biwesh Neupane [c]

[a] *IRC for Finance and Digital Economy, KFUPM Business School, King Fahd University of Petroleum and Minerals, KSA*
[b] *School of Business, Economics and Information Systems, University of Passau, Innstrasse 27, Passau 94030, Germany*
[c] *Department of Finance, University of Birmingham, Edgbaston, Birmingham B15 2TT, United Kingdom*

ARTICLE INFO

ABSTRACT

The COVID-19 pandemic raised the question whether gold and sovereign bonds are a safe haven during epidemics. We study the effectiveness as safe haven during the epidemics caused by SARS, Ebola, Zika, Swine Flu, and COVID-19. To this end, this study employs a DCC-GARCH model to analyze the conditional correlations between daily returns of S&P 500 and MSCI Emerging Markets Index with gold and the major sovereign bonds. Our results show that gold is a weak safe haven for stock market investors during the epidemics, and U.S. treasuries are the safest option, followed by Japanese sovereign bonds.

1. Introduction

The global economy and financial markets have never been more gloomy than in response to the Coronavirus Disease 2019 (COVID-19) that has caused economic upheaval by placing millions of people under lockdown, throwing the global supply chains into disarray, and shutting down businesses around the world (Feyen et al., 2021). Consequently, there is no time more critical than now for investors to search for safe havens and reduce their portfolio risk using the correlations between the asset classes. During crises, gold and sovereign bonds have traditionally been safe havens for regions, including the U.S. and emerging stock markets (Triki and Maatoug, 2021). However, the recent evidence suggests that these previously proclaimed safe havens that were effective during previous situations are not as equally safe during the COVID-19 (Akhtaruzzaman et al., 2021). Hence, there is a need to re-examine the refugee characteristics of gold and sovereign bonds during the COVID-19 compared to previous epidemics such as Severe Acute Respiratory Syndrome (SARS), Ebola, Zika, and Swine Flu in both U.S. and emerging stock markets.[1]

Furthermore, the analysis of safe havens for the U.S. and emerging stock markets like China is also warranted by investors

---

* Corresponding author.
  E-mail address: harald.kinateder@uni-passau.de (H. Kinateder).
[1] A related but separate group of studies in the area analyzes safe haven properties of cryptocurrencies (see e.g. Bouri et al., 2020, Hasan et al., 2022, Melki and Nefzi 2022). However, we do not consider cryptocurrencies as we analyze a broad sample of epidemics that spans long before cryptocurrencies have been invented.

considering the distinct 'safety' they provide to the investors and the 'cost' at which this safety is purchased (Ming et al., 2020; Chen et al., 2021). Gold is comparatively riskier between the two candidates, with more volatile returns than a fixed return on sovereign bonds when held until maturity. However, gold can shield investors from additional threats to weak bonds, i.e., default risk, currency risk, and inflation (Wang et al., 2019; Wang et al., 2021). Similarly, given the associated storage costs for physical gold, investors generally have to pay a premium to buy gold compared to sovereign bonds. All these 'safety' and cost-related facets of gold and sovereign bonds render them one of the most exciting pairs for joint analysis.

In this paper, we use a bivariate Dynamic Conditional Correlation (DCC) Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model to examine whether gold and the world's dominant sovereign bonds, i.e., ten years treasury bonds issued by the United States (U.S.), Japan, Germany, and Switzerland served as a safe haven during all the epidemics declared by the World Health Organization (WHO) in recent times namely SARS, Ebola, Zika, Swine Flu, and COVID-19. While the existing health crisis literature examines safe haven properties mainly in the COVID-19 period only (Disli et al., 2021), our paper contributes to the literature by comparing the effectiveness of using a much larger set of sovereign bonds and gold and studying the historical performance during the previous epidemics caused by SARS, Ebola, Zika, and Swine Flu. In addition, this paper extends the earlier work of Kinateder et al. (2021), which focuses on safe haven within asset classes, by analyzing the safe haven characteristics of gold and sovereign bonds for stock market investors. From the perspective of macro safe havens, our study opens an avenue of strategic investment considerations by bridging a significant void in the related literature.

The paper is structured as follows. Next, the data and methodology used for the primary analysis are presented. Then, Section 3 shows the empirical findings from the DCC-GARCH model. The final section articulates the closing comments.

2. Data and methodology

2.1. Data

We collected the daily closing prices, $P_{i,t}$, of gold, sovereign bond indices, and the U.S. and emerging stock market indices from DataStream for the period of January 1, 2001, to February 9, 2022, and calculate the daily continuously compounded returns as $R_{i,t} = \ln(P_{i,t}) - \ln(P_{i,t-1})$. Key summary statistics are reported in Table 1. Panel A contains full sample returns of U.S. 10 Year Bond Index - US10YR (BMUS10Y), Japan 10 Year Bond Index - JP10YR (BMJPS10Y), German 10 Year Bond Index - BD10YR (BMBDS10Y), Swiss 10 Year Bond Index - SW10YR (BMSWS10Y), S&P GSCI Gold Index (GSGCTOT), S&P 500 Index (S&PCOMP), and MSCI Emerging Markets Index (MSEMKF). This is followed by Panel B for the SARS sample, Panel C for the Ebola sample, Panel D for the Zika sample, Panel E for the Swine Flu sample, and Panel F for the COVID-19 sample for the same variables. As discussed before, the total sample period is from January 1, 2001, to February 9, 2022; out of this, the 200 trading days period for SARS is March 12, 2003, to December 16, 2003; followed by Ebola August 7, 2014, to May 13, 2015; Zika November 17, 2015, to August 22, 2016; Swine Flu April 27, 2009, to January 29, 2010; and COVID-19 January 30, 2020, to November 4, 2020. Jarque-Bera's (JB) test results in Table 1 reject the null hypotheses of normality even at the 1% significance level; however, the JB statistic is higher for smaller sub-samples as expected. All return series show substantial kurtosis in the full sample, and returns of gold, U.S. sovereign bonds, and stock markets are mildly negatively skewed. The subsamples show similar but slight differences due to the specific nature of each epidemic.

Next, Table 2 reports the pairwise unconditional Pearson correlations and associated *p*-values for each pair of variables. Overall, we can see a medium stable absolute correlation for all the sample periods. Based on this preliminary finding, further investigation on safe haven properties can be made using DCC in the rest of the paper.

2.2. Methodology

We use Engle's (2002) bivariate DCC-GARCH model for conditional correlation analysis as DCC has been defined as the preferred model by most authors in our field (Liu and Lee, 2022; Zhang et al., 2021). The model is defined as follows:

$$R_t = \mu_t + \sum\nolimits_t^{0.5} z_t, \tag{1}$$

where $R_t = (R_{s,t}, R_{h,t})'$ is a vector of conditional stock returns, $R_{s,t}$, and returns of a safe haven asset, $R_{h,t}$, with $h \in \{gold, bonds\}$. The conditional mean vector is $\mu_t = (\mu_{s,t}, \mu_{h,t})'$, and z_t is an (2×1) i.i.d. random vector variable. The conditional correlations are calculated as in Kinateder et al. (2021):

$$\rho_{s,h,t} = q_{s,h,t} \Big/ \left(q_{s,s,t} q_{h,h,t} \right)^{0.5}, \tag{3}$$

where $q_{s,h,t}$ is the conditional covariance $q_{s,h,t} = Cov(R_{s,t}, R_{h,t} | \mathscr{F}_{t-1})$ between equity returns s and returns of a safe haven asset, and $q_{s,s,t} = Var(R_{s,t} | \mathscr{F}_{t-1})$ and $q_{h,h,t} = Var(R_{h,t} | \mathscr{F}_{t-1})$ represent the conditional variances of $R_{s,t}$ and $R_{h,t}$.

Based on Eq. (3), we characterize the studied assets (gold and sovereign bonds) as a *strong (weak) safe haven* if they are negatively correlated (uncorrelated) with an equity portfolio (Baur and McDermott, 2010). In an epidemic, we expect the correlation to be negative between safe haven assets and stocks as there is an increased level of uncertainty. This environment makes it hard for investors to anticipate future cashflows of their stock market investments. Therefore, they close their risky positions in stocks and shift their funds into safe havens. This economic mechanism should lead to declining stock markets and rising prices of gold and bonds.

Table 1
Descriptive statistics.

	US10YR	JP10YR	BD10YR	SW10YR	GOLD	EMER	S&P 500	US10YR	JP10YR	BD10YR	SW10YR	GOLD	EMER	S&P 500
	Panel A: Full Sample							**Panel D: ZIKA Sample**						
Mean	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Standard Deviation	0.005	0.007	0.007	0.007	0.011	0.012	0.012	0.004	0.008	0.006	0.006	0.010	0.011	0.009
Kurtosis	6.108	7.179	7.031	25.144	8.828	11.333	15.262	4.169	5.900	5.420	4.101	5.773	3.910	4.447
Skewness	-0.061	0.305	0.086	0.823	-0.311	-0.546	-0.426	0.017	0.678	0.549	0.469	0.756	-0.237	-0.378
Jarque-Bera	2219.708	4092.537	3734.351	113141.616	7883.567	16206.991	34668.372	11.389	85.432	58.855	17.434	83.115	8.777	22.203
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.012	0.000
ADF	-74.859	-72.837	-74.717	-71.953	-74.902	-60.897	-83.648	-15.962	-13.550	-15.371	-14.269	-15.563	-11.359	-15.469
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	5507	5507	5507	5507	5507	5507	5507	200	200	200	200	200	200	200
	Panel B: SARS Sample							**Panel E: SWINE FLU Sample**						
Mean	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.001
Standard Deviation	0.006	0.007	0.009	0.009	0.010	0.008	0.010	0.006	0.008	0.006	0.007	0.010	0.014	0.012
Kurtosis	3.146	4.450	2.829	2.953	3.640	3.162	4.411	3.646	2.865	4.753	4.012	3.997	3.945	3.562
Skewness	-0.337	0.328	-0.337	-0.470	-0.462	-0.126	0.115	-0.303	-0.133	0.201	0.205	-0.468	0.283	-0.168
Jarque-Bera	3.962	21.100	4.033	7.396	10.518	0.747	17.027	6.543	0.740	26.971	9.927	15.575	10.122	3.567
p-value	0.138	0.000	0.133	0.025	0.005	0.688	0.000	0.038	0.691	0.000	0.007	0.000	0.006	0.168
ADF	-14.188	-12.778	-13.568	-13.166	-15.110	-12.315	-16.598	-15.073	-13.323	-14.152	-16.495	-13.964	-11.741	-12.886
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	200	200	200	200	200	200	200	200	200	200	200	200	200	200
	Panel C: EBOLA Sample							**Panel F: COVID-19 Sample**						
Mean	0.001	-0.001	-0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Standard Deviation	0.004	0.006	0.006	0.012	0.010	0.008	0.008	0.006	0.006	0.007	0.007	0.014	0.016	0.024
Kurtosis	3.450	5.359	3.297	63.230	4.526	2.829	3.434	9.180	7.663	6.983	5.953	6.609	7.648	10.210
Skewness	-0.164	-0.375	0.071	6.343	0.341	0.048	-0.037	-0.423	0.365	-0.180	-0.577	-0.016	-1.016	-0.777
Jarque-Bera	2.580	51.075	0.903	31571.300	23.269	0.322	1.618	324.261	185.647	133.270	83.769	108.547	214.460	453.275
p-value	0.275	0.000	0.637	0.000	0.000	0.851	0.445	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ADF	-15.516	-13.600	-15.271	-10.252	-15.431	-10.463	-14.715	-12.204	-10.281	-10.928	-14.152	-14.152	-13.374	-20.644
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	200	200	200	200	200	200	200	200	200	200	200	200	200	200

This table reports key descriptive statistics for daily returns, i.e., $R_t = \ln(P_t) - \ln(P_{t-1})$ of the studied financial times series (with DataStream code in parentheses below), including Mean, Standard Deviation, Kurtosis, Skewness, Jarque-Bera Normality Test Statistics with p-value, Augmented Dickey-Fuller (ADF) Unit Root Test Statistics with the p-value. Panel A contains full sample returns of U.S. 10 Year Bond Index - US10YR (BMUS10Y), Japan 10 Year Bond Index - JP10YR (BMJPS10Y), German 10 Year Bond Index - BD10YR (BMBDS10Y), Swiss 10 Year Bond Index - SW10YR (BMSWS10Y), S&P GSCI Gold Index (GSGCTOT), S&P 500 Index (S&PCOMP) and MSCI Emerging Markets Index (MSEMKF). This is followed by Panel B for the SARS sample, Panel C for the EBOLA sample, Panel D for the ZIKA sample, Panel E for the SWINE FLU sample, and Panel F for the COVID-19 sample for the same variables. The total sample period is from January 1, 2001, to February 9, 2022; out of this, the 200 trading days period for SARS is March 12, 2003, to December 16, 2003; followed by Ebola August 7, 2014, to May 13, 2015; Zika November 17, 2015, to August 22, 2016; Swine Flu April 27, 2009, to January 29, 2010; and COVID-19 January 30, 2020, to November 4, 2020.

Table 2
Pearson correlation.

	US10YR	JP10YR	BD10YR	SW10YR	GOLD	EMER	S&P 500	US10YR	JP10YR	BD10YR	SW10YR	GOLD	EMER	S&P 500
	Panel A: Full Sample							**Panel B: SARS Sample**						
US10YR	1.000							1.000						
p-value	0.000							0.000						
JP10YR	0.321	1.000						0.101	1.000					
p-value	0.000	0.000						0.153	0.000					
BD10YR	0.338	0.459	1.000					0.467	0.407	1.000				
p-value	0.000	0.000	0.000					0.000	0.000	0.000				
SW10YR	0.282	0.478	0.768	1.000				0.366	0.415	0.894	1.000			
p-value	0.000	0.000	0.000	0.000				0.000	0.000	0.000	0.000			
GOLD	0.142	0.252	0.391	0.379	1.000			0.177	0.204	0.540	0.483	1.000		
p-value	0.000	0.000	0.000	0.000	0.000			0.012	0.004	0.000	0.000	0.000		
EMER	-0.236	-0.211	0.090	-0.010	0.150	1.000		-0.205	-0.117	-0.167	-0.286	-0.015	1.000	
p-value	0.000	0.000	0.000	0.470	0.000	0.000		0.004	0.098	0.018	0.000	0.837	0.000	
S&P 500	-0.367	-0.189	-0.067	-0.119	-0.008	0.452	1.000	-0.280	-0.063	-0.333	-0.287	-0.317	0.242	1.000
p-value	0.000	0.000	0.000	0.000	0.539	0.000	0.000	0.000	0.372	0.000	0.000	0.000	0.001	0.000
	Panel C: EBOLA Sample							**Panel D: ZIKA Sample**						
US10YR	1.000							1.000						
p-value	0.000							0.000						
JP10YR	0.306	1.000						0.438	1.000					
p-value	0.000	0.000						0.000	0.000					
BD10YR	0.287	0.567	1.000					0.335	0.486	1.000				
p-value	0.000	0.000	0.000					0.000	0.000	0.000				
SW10YR	0.182	0.234	0.164	1.000				0.188	0.490	0.811	1.000			
p-value	0.010	0.001	0.020	0.000				0.008	0.000	0.000	0.000			
GOLD	0.288	0.445	0.270	0.344	1.000			0.361	0.583	0.463	0.427	1.000		
p-value	0.000	0.000	0.000	0.000	0.000			0.000	0.000	0.000	0.000	0.000		
EMER	-0.157	-0.022	0.002	0.064	0.029	1.000		-0.299	-0.329	0.017	-0.016	-0.181	1.000	
p-value	0.026	0.755	0.978	0.369	0.687	0.000		0.000	0.000	0.816	0.828	0.010	0.000	
S&P 500	-0.333	-0.280	-0.073	-0.076	-0.179	0.389	1.000	-0.459	-0.390	-0.187	-0.190	-0.306	0.502	1.000
p-value	0.000	0.000	0.303	0.284	0.011	0.000	0.000	0.000	0.000	0.008	0.007	0.000	0.000	0.000
	Panel E: SWINE-FLU Sample							**Panel F: COVID-19 Sample**						
US10YR	1.000							1.000						
p-value	0.000							0.000						
JP10YR	0.409	1.000						0.511	1.000					
p-value	0.000	0.000						0.000	0.000					
BD10YR	0.207	0.497	1.000					0.481	0.547	1.000				
p-value	0.003	0.000	0.000					0.000	0.000	0.000				
SW10YR	0.104	0.414	0.875	1.000				0.422	0.602	0.859	1.000			
p-value	0.142	0.000	0.000	0.000				0.000	0.000	0.000	0.000			
GOLD	-0.134	0.121	0.437	0.380	1.000			0.153	0.155	0.339	0.346	1.000		
p-value	0.059	0.089	0.000	0.000	0.000			0.031	0.029	0.000	0.000	0.000		
EMER	-0.275	-0.287	0.282	0.231	0.404	1.000		-0.358	-0.189	0.112	0.071	0.143	1.000	
p-value	0.000	0.000	0.000	0.001	0.000	0.000		0.000	0.007	0.115	0.316	0.044	0.000	
S&P 500	-0.328	-0.215	0.142	0.134	0.392	0.560	1.000	-0.500	-0.254	-0.054	-0.072	0.188	0.604	1.000
p-value	0.000	0.002	0.045	0.059	0.000	0.000	0.000	0.000	0.000	0.445	0.311	0.008	0.000	0.000

This table reports the pairwise Pearson correlations and associated *p*-values for the daily returns, i.e., $R_t = \ln(P_t) - \ln(P_{t-1})$ of the studied financial times series (with DataStream code in parentheses below). Panel A contains full sample returns of U.S. 10 Year Bond Index - US10YR (BMUS10Y), Japan 10 Year Bond Index - JP10YR (BMJPS10Y), German 10 Year Bond Index - BD10YR (BMBDS10Y), Swiss 10 Year Bond Index - SW10YR (BMSWS10Y), S&P GSCI Gold Index (GSGCTOT), MSCI Emerging Markets Index (MSEMKF) and S&P 500 Index (S&PCOMP). This is followed by Panel B for the SARS sample, Panel C for the EBOLA sample, Panel D for the ZIKA sample, Panel E for the SWINE FLU sample, and Panel F for the COVID-19 sample for the same variables. The total sample period is from January 1, 2001, to February 9, 2022; out of this, the 200 trading days period for SARS is March 12, 2003, to December 16, 2003; followed by Ebola August 7, 2014, to May 13, 2015; Zika November 17, 2015, to August 22, 2016; Swine Flu April 27, 2009, to January 29, 2010; and COVID-19 January 30, 2020, to November 4, 2020.
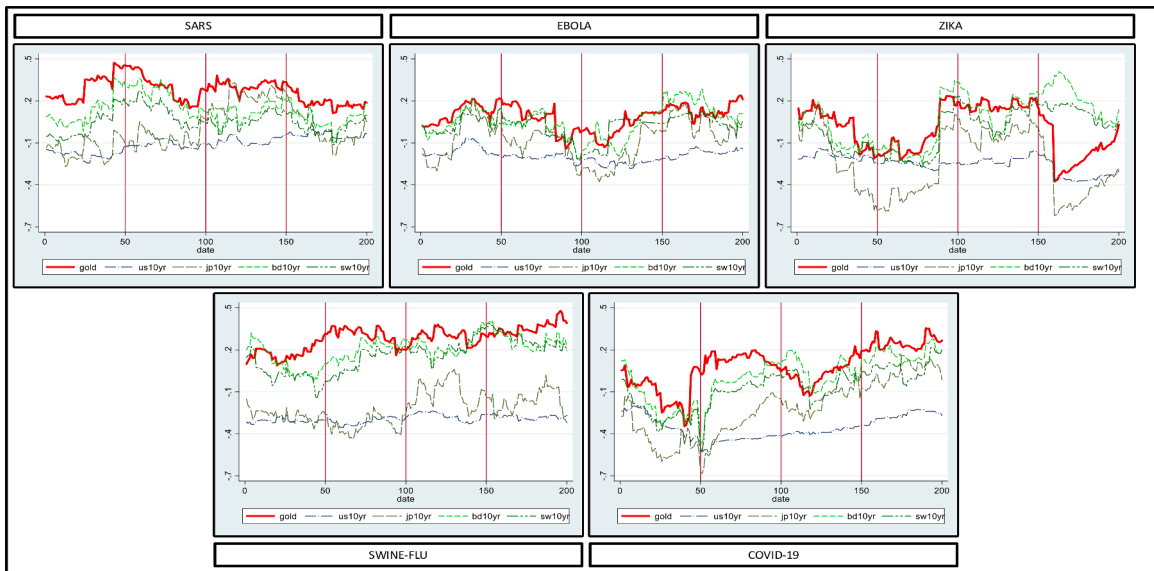
Fig. 1. Dynamic correlations between MSCI Emerging Markets Index and safe haven assets

This figure plots the time-varying conditional correlations for MSCI Emerging Markets Index and safe haven assets (see Eq. (3)) arising from our bivariate DCC-AR(4)-GARCH(1,1) model for the first 200 days of SARS, Ebola, Zika, Swine Flu, and COVID-19. The 200 trading days period for SARS is March 12, 2003, to December 16, 2003; followed by Ebola August 7, 2014, to May 13, 2015; Zika November 17, 2015, to August 22, 2016; Swine Flu April 27, 2009, to January 29, 2010; COVID-19 January 30, 2020, to November 4, 2020. The variables included in the pairwise correlations between the MSCI Emerging Markets Index (MSEMKF) and one of the five safe haven assets, including the U.S. 10 Year Bond Index - US10YR (BMUS10Y), Japan 10 Year Bond Index - JP10YR (BMJPS10Y), German 10 Year Bond Index - BD10YR (BMBDS10Y), Swiss 10 Year Bond Index - SW10YR (BMSWS10Y) and, S&P GSCI Gold Index (GSGCTOT).
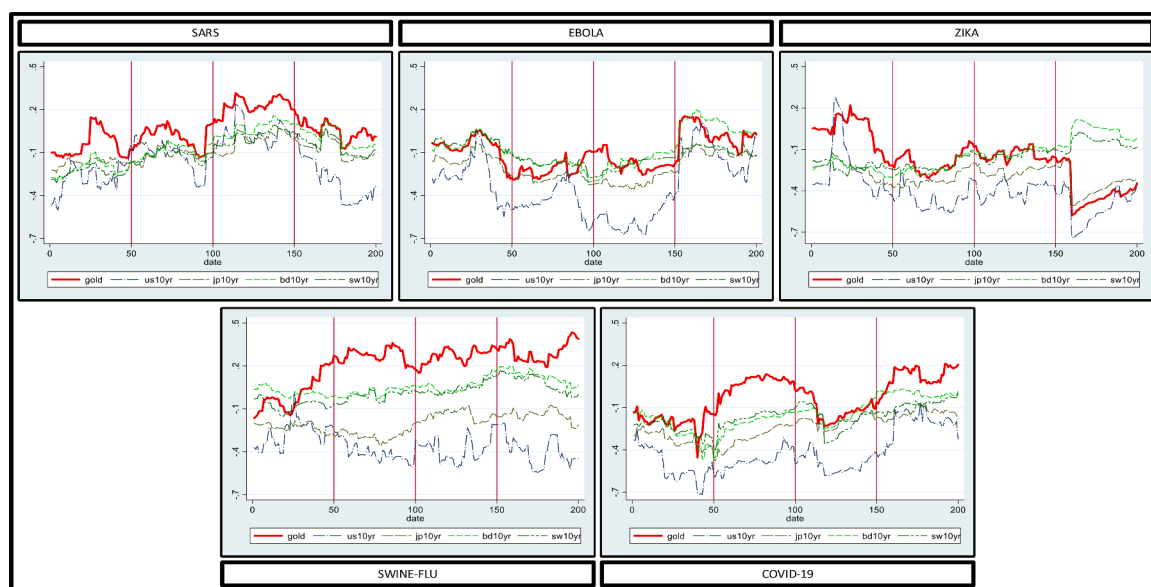
3. Results and discussion

Fig. 1 plots the time-varying conditional correlations arising from our bivariate DCC-AR(4)-GARCH (1,1) model for the first 200 days of SARS (March 12, 2003, to December 16, 2003), Ebola (August 7, 2014, to May 13, 2015), Zika (November 17, 2015, to August 22, 2016), Swine Flu (April 27, 2009, to January 29, 2010), and COVID-19 (January 30, 2020, to November 4, 2020).[2]

The variables included in the pairwise correlations between the *MSCI Emerging Markets Index* and one of the five safe haven indexes, are the U.S. 10 Year Bond Index, Japan 10 Year Bond Index, German 10 Year Bond Index, and Swiss 10 Year Bond Index, and S&P GSCI Gold Index. The figure illustrates that the correlations are time-varying, with the most significant negative correlations in COVID-19. U.S. bond has always stayed negative and stable during all the epidemics; such can be regarded as a robust and safe-haven investment in all cases of outbreaks. This pattern is also shown with the Japanese bonds at a lighter scale. However, gold has correlations around zero in virtually all epidemics. Hence, gold is only a weak safe haven for emerging stock markets during any pandemic. The most considerable spread difference between U.S./Japan bonds and gold is visible in the Swine Flu sample. This can be explained by the nature of the epidemic, as Swine Flu affected Africa and South East Asia hardest (Sampath et al., 2021). Furthermore, all other epidemics showed a remarkably similar movement in the correlation plots other than Swine Flu.

Fig. 2 plots the time-varying conditional correlations (see Eq. (3)) arising from our previous bivariate DCC-AR(4)-GARCH(1,1) model for the first 200 days of SARS, Ebola, Zika, Swine Flu, and COVID-19. The variables included in the pairwise correlations between the *S&P 500 Index* and one of the five safe haven indexes, are the U.S. 10 Year Bond Index, Japan 10 Year Bond Index, German 10 Year Bond Index, Swiss 10 Year Bond Index, and S&P GSCI Gold Index. We can observe that U.S./Japan bonds are still the best choice as safe haven. Furthermore, Swine Flu still shows the highest spread between U.S./Japan bonds and the rest.

In addition, our analysis shows that the remainder of the sovereign bonds of Germany and Switzerland are not outperformed by gold. These bonds lie between a weak and robust safe haven status. This result shows the importance of government bonds from countries with high credit ratings as safe-haven assets.

---

[2] The starting dates for each epidemic corresponds to the date when WHO declared a public health emergency. In order to address serial correlation in the return series, we employ an autoregressive (AR) term in the mean equation of the DCC-GARCH model.

Fig. 2. Dynamic correlations between S&P 500 market index and safe haven assets.

This figure plots the time-varying conditional correlations for S&P 500 Index (see Eq. (3)) and safe haven assets arising from our bivariate DCC-AR (4)-GARCH(1,1) model for the first 200 days of SARS, Ebola, Zika, Swine Flu, and COVID-19. The 200 trading days period for SARS is March 12, 2003, to December 16, 2003; followed by Ebola August 7, 2014, to May 13, 2015; Zika November 17, 2015, to August 22, 2016; Swine Flu April 27, 2009, to January 29, 2010; and COVID-19 January 30, 2020, to November 4, 2020. The variables included in the pairwise correlations between the S&P 500 Index (S&PCOMP) and one of the five safe haven assets, including the U.S. 10 Year Bond Index - US10YR (BMUS10Y), Japan 10 Year Bond Index - JP10YR (BMJPS10Y), German 10 Year Bond Index - BD10YR (BMBDS10Y), Swiss 10 Year Bond Index - SW10YR (BMSWS10Y) and, S&P GSCI Gold Index (GSGCTOT).

4. Conclusion

This study tests the validity of gold and the major sovereign bonds as a safe haven for stock market investors. It compares its effectiveness with its historical performance during the previous epidemics caused by SARS, Ebola, Zika, Swine Flu, and COVID-19. Our results show that most of the time gold is a weak safe haven for investors during all the epidemics. However, the U.S. and Japanese sovereign bonds have performed as vital safe-haven jurisdictions for emerging and U.S. stock market investors. In addition, we also document safe haven properties for German and Swiss sovereign bonds. These findings have significant implications for the current time as inflation is rising worldwide, including the U.S. As the difference is getting more prominent between the real and nominal rate, investors are more concerned about their investments as the portfolio's intrinsic value is getting more significant to them. A possible avenue of future research can be the implication on international stock markets in this scenario as they are heavily concentrated on interest sensitive sectors.

References

Akhtaruzzaman, M., Boubaker, S., Lucey, B.M., Sensoy, A., 2021. Is gold a hedge or a safe-haven asset in the COVID–19 crisis? Econ. Model. 102, 105588.

Baur, D.G., McDermott, T.K., 2010. Is gold a safe haven? International evidence. J. Bank. Financ. 34, 1886–1898.

Bouri, E., Lucey, B., Roubaud, D., 2020. Cryptocurrencies and the downside risk in equity investments. Financ. Res. Lett. 33, 101211.

Chen, R., Wei, B., Jin, C., Liu, J., 2021. Returns and volatilities of energy futures markets: roles of speculative and hedging sentiments. Int. Rev. Financ. Anal. 76, 101748.

Disli, M., Nagayev, R., Salim, K., Rizkiah, S.K., Aysan, A.F., 2021. In search of safe haven assets during COVID-19 pandemic: an empirical analysis of different investor types. Res. Int. Bus. Financ. 58, 101461.

Engle, R., 2002. Dynamic conditional correlation: A simple class of multivariate generalized autoregressive conditional heteroskedasticity models. J. Bus. Econ. Stat. 20, 339–350.

Feyen, E., Gispert, T.A., Kliatskova, T., Mare, D.S., 2021. Financial sector policy response to COVID-19 in emerging markets and developing economies. J. Bank. Financ. 133, 106184.

Hasan, M.B., Hassan, M.K., Karim, Z.A., Rashid, M.M., 2022. Exploring the hedge and safe haven properties of cryptocurrency in policy uncertainty. Financ. Res. Lett. 46, 102272.

Kinateder, H., Campbell, R., Choudhury, T., 2021. Safe haven in GFC versus COVID-19: 100 turbulent days in the financial markets. Financ. Res. Lett. 43, 101951.

Liu, M., Lee, C.C., 2022. Is gold a long-run hedge, diversifier, or safe haven for oil? Empirical evidence based on DCC-MIDAS. Resour. Policy 76, 102703.

Melki, A., Nefzi, N., 2022. Tracking safe haven properties of cryptocurrencies during the COVID-19 pandemic: a smooth transition approach. Financ. Res. Lett. 46, 102243.

Ming, L., Zhang, X., Liu, Q., Yang, S., 2020. A revisit to the hedge and safe haven properties of gold: new evidence from China. J. Futur. Mark. 40, 1442–1456.

Sampath, S., Khedr, A., Qamar, S., Tekin, A., Singh, R., Green, R., Kashyap, R., 2021. Pandemics throughout the history. Cureus 13, e18136.

Triki, M.B., Maatoug, A.B., 2021. The GOLD market as a safe haven against the stock market uncertainty: evidence from geopolitical risk. Resour. Policy 70, 101872.

Wang, G., Tang, Y., Xie, C., Chen, S., 2019. Is bitcoin a safe haven or a hedging asset? Evidence from China. J. Manag. Sci. Eng. 4, 173–188.

Wang, P., Zhang, H., Yang, C., Guo, Y., 2021. Time and frequency dynamics of connectedness and hedging performance in global stock markets: bitcoin versus conventional hedges. Res. Int. Bus. Financ. 58, 101479.

Zhang, Y., Wang, M., Xiong, X., Zou, G., 2021. Volatility spillovers between stock, bond, oil, and gold with portfolio implications: Evidence from China. Financ. Res. Lett. 40, 101786.